

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Household and similar electrical appliances – Test code for the determination of airborne acoustical noise –
Part 2-18: Particular requirements for electric water heaters**

**Appareils électrodomestiques et analogues – Code d'essai pour la détermination du bruit aérien –
Partie 2-18: Exigences particulières pour les chauffe-eau électriques**

<https://standards.iteh.ai/catalog/standards/sist/90b78fb4-7269-44f9-8252-ab50e9e682a2/iec-60704-2-18-2022>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2022 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
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.

About IEC publications

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 It also gives information on projects, replaced and withdrawn publications.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.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Household and similar electrical appliances – Test code for the determination of airborne acoustical noise –
Part 2-18: Particular requirements for electric water heaters**

**Appareils électrodomestiques et analogues – Code d'essai pour la détermination du bruit aérien –
Partie 2-18: Exigences particulières pour les chauffe-eau électriques**

<https://standards.iteh.ai/catalog/standards/sist/90b78fb4-7269-44f9-8252-ab50e9e682a2/iec-60704-2-18-2022>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 17.140.20; 97.100.10

ISBN 978-2-8322-1073-7

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	7
4 Measurement methods and acoustical environments	7
5 Instrumentation.....	12
6 Operation and location of appliances under test	12
7 Measurement of sound pressure levels.....	13
8 Calculation of sound pressure and sound power levels.....	14
9 Information to be recorded.....	14
10 Information to be reported	14
Annexes	15
Annex A (normative) Standard test table.....	15
Bibliography.....	16
Figure 101 – Scanning patterns according to ISO 9614-2.....	10
Table 101 – <i>C</i> values	10
Table 102 – <i>S</i> values.....	11
Table 1 – Standard deviations of sound power levels.....	11
Table 2 – Standard deviations for declaration and verification.....	11

<https://standards.iteh.ai/standards/sist/90b78fb4-7269-44f9-8252-ab50e9e682a2/iec-60704-2-18-2022>

<https://standards.iteh.ai/catalog/standards/sist/90b78fb4-7269-44f9-8252-ab50e9e682a2/iec-60704-2-18-2022>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –
TEST CODE FOR THE DETERMINATION
OF AIRBORNE ACOUSTICAL NOISE –**

Part 2-18: Particular requirements for electric water heaters

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.

IEC 60704-2-18 has been prepared by subcommittee 59C: Electrical heating appliances for household and similar purposes, of IEC technical committee 59: Performance of household and similar electrical appliances. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
59C/262/CDV	59C/266A/RVC

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

The language used for the development of this International Standard is English.

This document is intended to be used in conjunction with IEC 60704-1:2021, *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 1: General requirements*.

The relevant text of IEC 60704-1:2021 as amended by this publication establishes the test code for electrical water heaters.

This document supplements or modifies the corresponding clauses in IEC 60704-1:2021. When a particular subclause of IEC 60704-1:2021 is not mentioned in this document, that subclause is applicable as far as reasonable. Where this document states "addition", "modification", "replacement" or "deletion", the relevant requirements, test specifications or explanatory matter in IEC 60704-1:2021 should be adapted accordingly.

Subclauses, figures and tables that are additional to those in IEC 60704-1:2021 are numbered starting from 101.

Unless notes are in a new subclause or involve notes in IEC 60704-1:2021, they are numbered starting from 101, including those in a replaced clause or subclause.

A list of all the parts in the IEC 60704 series, under the general title *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- <https://standards.iso.org/standards/catalog/standards/sist/90b78fb4-7269-44f9-8252-ab50e9e682a2/iec-60704-2-18-2022>
- reconfirmed,
 - withdrawn,
 - replaced by a revised edition, or
 - amended.

INTRODUCTION

The measuring conditions specified in this part of IEC 60704 provide for sufficient accuracy in determining the noise emitted and comparing the results of measurements taken by different laboratories whilst simulating, as far as possible, the practical use of household water heaters.

It is recommended to consider the determination of noise levels as part of a comprehensive testing procedure covering many aspects of the properties and performance of household water heaters.

Special forms of electric water heaters generate remarkable noise, which is not common for conventional electric water heaters. In order to capture these special products, this document was developed. It provides a noise measurement procedure, which serves as an instrument for realizing technical improvements on the products and prevents false declarations in regulatory systems (e.g. European regulation on energy labelling).

NOTE As stated in the introduction to IEC 60704-1, this test code is concerned with airborne noise only.

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

[IEC 60704-2-18:2022](#)

<https://standards.iteh.ai/catalog/standards/sist/90b78fb4-7269-44f9-8252-ab50e9e682a2/iec-60704-2-18-2022>

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – TEST CODE FOR THE DETERMINATION OF AIRBORNE ACOUSTICAL NOISE –

Part 2-18: Particular requirements for electric water heaters

1 Scope

This clause of IEC 60704-1:2021 is applicable except as follows:

Addition:

These particular requirements apply to single-unit electric water heaters for household and similar use intended for placing on the floor against a wall, for building-in or placing under a counter, a kitchen worktop or under a sink, for wall-mounting or on a counter.

NOTE 1 Conventional electric water heaters that make use of the Joule effect in electric resistance heating elements normally do not produce any noise emissions. However, there are products with noise-producing components on the market. Examples of such components are motors and pumps e.g. for increasing water pressure.

NOTE 2 Noise of control elements is disregarded because of the sporadic character and its normally very low sound level.

This document does not apply to:

- combustion water heaters;
- water kettles;
- heat pump water heaters;
- conventional electric storage water heaters as defined in IEC 60335-2-21:2012, Clause 1;
- instantaneous electric water heaters without any noise-producing components such as motors and pumps.

2 Normative references

This clause of IEC 60704-1:2021 is applicable except as follows:

Addition:

IEC 60379:—¹, *Methods for measuring the performance of electric storage water-heaters for household purposes*

IEC 60704-1:2021, *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 1: General requirements*

IEC 63159-1, *Electric instantaneous water heaters – Methods for measuring the performance – Part 1: General requirements*

IEC 63159-2-1, *Electric instantaneous water heaters – Methods for measuring the performance – Part 2-1: Multifunctional electric instantaneous water heaters*

¹ Under development. Stage at the time of publication: IEC CDV 60379:2021.

IEC 63159-2-2, *Electric instantaneous water heaters – Methods for measuring the performance – Part 2-2: Efficiency of single point of use electric instantaneous water heaters*

3 Terms and definitions

This clause of IEC 60704-1:2021 is applicable except as follows:

3.3 operational cycle

Replacement of the definition:

specific sequence of operational periods occurring while the appliance under test performs a complete work cycle; during the operational cycle, each operational period is associated with a specific process that can occur only once

Addition:

3.101 noise-producing components

components that produce noise emissions during the water heating and/or the tapping process

Note 1 to entry: Components including motors, but not exclusively (e.g. pumps), are considered to be noise-producing components. Joule effect heating elements are not considered to be noise-producing components. Noise may be generated by boiling and cooking and by generating steam bubbles.

3.102 control components

components that are used for the controlling purposes of the water heater

4 Measurement methods and acoustical environments

This clause of IEC 60704-1:2021 is applicable except as follows:

4.1 General

Addition after 2nd paragraph.

The methods specified in ISO 3743-1, ISO 3743-2 and ISO 3744 can be used for measuring noise emitted by electric water heaters.

4.2 Direct method

Addition:

4.2.101 Intensity method

Measurement in a free field, reverberation, or special reverberation room is often not possible because the appliance cannot be placed in such an environment. In this case, the intensity method shall be applied accordingly. The acoustical environments shall be applied as detailed in 4.4.1.

For the intensity method, the standard deviations as given in 4.5.2 apply.

4.4 Acoustical environments

Addition:

4.4.101 Acoustical environments for intensity method

4.4.101.1 General

Although the test of sound intensity does not require a special environment, it is recommended to minimize reflections of sound waves due to hard walls or other objects in the surroundings, which are not included in the measuring surface. A coating made of absorbent foam on the walls highly facilitates fulfilling the required conditions for a test result conforming to ISO 9614-1:1993, ISO 9614-2:1996 and ISO 9614-3:2002.

The general requirements of ISO 9614-1:1993, ISO 9614-2:1996 and ISO 9614-3:2002 shall be applied. These standards enable provisions for sound power level according to category 2 or 3. The test shall comply with category 2.

4.4.101.2 Principle

The sound power of the electric water heater is determined by measuring the sound intensity vector and integrating it over a fictitious measurement surface, which surrounds the electric water heater.

Since the sound intensity method can distinguish sound waves coming from the inside and the outside of the measurement surface, no special environment is needed for the test, as long as the background noise is stationary.

4.4.101.3 Measurement points and procedure

4.4.101.3.1 General

The measuring points are located on a fictitious measuring surface, which completely surrounds the object under examination. The floor and any walls that are included in the surface shall be reflective (absorption factor < 0,06, usually fulfilled by concrete or masonry). No absorbing materials may be placed inside the measuring surface. A cuboid shape is recommended for the measuring surface because it is easier to manage.

Every side of the surface, except for the reflective walls, are divided into segments of the area S_i . The surface areas of the segments do not have to be of equal size, but calculation of the according sound power levels is easier if they are.

During the test, the sound field caused by the examined sound source and background noise shall be stationary.

The temporal variability of the sound field shall be determined by the following test.

Choose a “typical” test position on the measurement surface. Carry out 10 consecutive tests of the normal sound intensity I_n , at this position. The temporal variability indicator shall be calculated in accordance with Equation (1)

$$F_1 = \frac{1}{I_n} \sqrt{\frac{1}{9} \sum_{k=1}^{10} (I_{nk} - \bar{I}_n)^2} \quad (1)$$

where

\bar{I}_n is the mean value of the 10 tests.

$$\bar{I}_n = \frac{1}{10} \sum_{k=1}^{10} I_{nk}$$

If F_1 is greater than 0,6, action shall be taken in order to reduce the temporal variability of extraneous noise, or the test period shall be increased.

4.4.101.3.2 Test in accordance with ISO 9614-1 (discrete points)

The measuring points are positioned in the centre of the surface segments. Their distance to the noise source shall be at least 0,5 m. The number of measuring points (and therefore surface segments) shall be at least 1 per m², but in any case, not less than 10. Regarding a common boiler, it is recommended to apply segments with dimensions of about 0,5 m × 0,5 m.

The measuring time for each point shall be at least 20 s to 30 s.

The quality of the mesh is verified by calculating the field non-uniformity indicator F_4 for each frequency band of interest in accordance with Equation (2)

$$F_4 = \frac{1}{\bar{I}_n} \sqrt{\frac{1}{N-1} \sum_{i=1}^N (I_{ni} - \bar{I}_n)^2} \quad (2)$$

where

N is the number of measuring points;

I_{ni} are the measured normal sound intensity values corresponding to the segment areas S_i ;

\bar{I}_n is the surface normal sound intensity determined in Equation (3).

$$\bar{I}_n = \frac{1}{N} \sum_{i=1}^N I_{ni} \quad (3)$$

The mesh of measuring points fulfils the requirements of ISO 9614-1, if

$$N > C F_4^2$$

where

C is taken from Table 101.

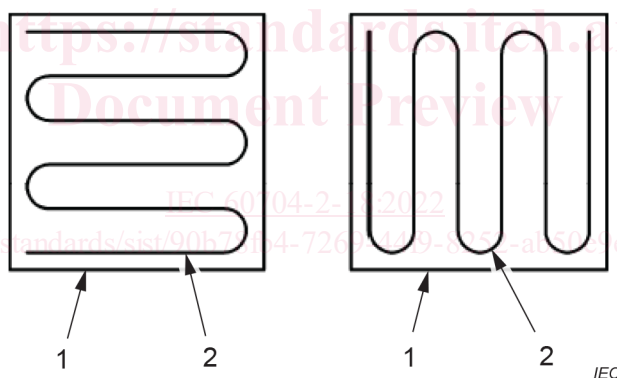
Table 101 – C values

Octave band centre frequencies Hz	One-third-octave band centre frequencies Hz	C		
		Category 1 (Precision class)	Category 2 (Engineering class)	
63 to 125	50 to 160	19	11	
250 to 500	200 to 630	29	19	
1 000 to 4 000	800 to 5 000	57	29	
	6 300	19	14	

If the criterion is not fulfilled in any frequency bands of interest, the number of surface segments, and therefore measuring points, shall be increased.

4.4.101.3.3 Test in accordance with ISO 9614-2 (scanning)

The distance between the noise source and the measuring surface shall be no less than 0,2 m. Each segment is scanned twice using patterns similar to those depicted in Figure 101. For the second scan of each segment, the pattern shall be rotated by 90° in accordance with Figure 101. The distance between adjacent scanning lines shall not exceed the distance to the noise source. The speed of the probe during scanning shall be in the range of 0,1 m/s to 0,5 m/s. The duration of each scan shall be no less than 20 s.



Key

- 1 segment area
- 2 measuring path

Figure 101 – Scanning patterns according to ISO 9614-2

The difference of the two sound power levels resulting from the two scans $L_{Wi} (1)$ and $L_{Wi} (2)$ for each segment is:

$$L_{Wi} (1) - L_{Wi} (2)$$

where

L_{Wi} shall be calculated in accordance with Equation (4):

$$L_{Wi} = 10 \cdot \lg \frac{I_{ni} \cdot S_i}{P_0} \text{ dB} \tag{4}$$