IEC 61874

Edition 2.0 2025-12

INTERNATIONAL STANDARD

Nuclear instrumentation - Geophysical borehole instrumentation to determine rock density ('density logging')

ICS 17.240

ISBN 978-2-8327-0844-6

IEC 61874:2025-12(en)

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 It also gives information on projects, replaced and withdrawn publications.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, graphical symbols and the glossary. 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 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

CONTENTS

FOREWORD 3
1 Scope 5
2 Normative references 5
3 Terms and definitions 5
4 Equipment 7
4.1 General 7
4.2 Logging probe 8
4.2.1 General 8
4.2.2 Density eccentric device 8
4.2.3 Gamma ray source 8
4.2.4 Gamma ray detector 8
4.2.5 Shielding and collimator 8
4.3 Hoisting system and depth measuring system 8
4.3.1 Hoisting system 8
4.3.2 Depth measuring system 8
4.4 Surface assembly 9
4.4.1 General 9
4.4.2 Data acquisition 9
4.4.3 Data display 9
4.4.4 Power assembly 9
5 General requirements 9
5.1 Design requirements 9
5.2 Operational requirements 10
5.2.1 General 10
5.2.2 Time constant τ 10
5.2.3 Logging speed 10
6 Mechanical and environmental performance requirements 10
7 Measurement errors 11
8 Operating time requirements 11
9 Power supply requirements 12
10 Mechanical and environmental performance tests 12
10.1 Temperature and pressure test 12
10.2 Vibration test 12
10.3 Continuous running time test 13
11 Functional tests 13
11.1 Calibration 13
11.2 Pre- and post-logging operation checks 13
11.2.1 Pre-logging checks 13
11.2.2 Post-logging checks 13
12 Safety requirements 14
12.1 Electrical safety requirements 14
12.2 Radiation safety requirements 14
13 Characteristics to be specified in the operation and maintenance documentation or certificate of the equipment 14

Table 1 – Operating and test conditions 10
Table 2 – Environmental conditions for surface assembly 11

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

Nuclear instrumentation - Geophysical borehole instrumentation to determine rock density ("density logging")

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61874 has been prepared by IEC technical committee 45: Nuclear instrumentation. It is an International Standard.

This second edition cancels and replaces the first edition published in 1998. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Clause 2: updating of reference documents;
b) Clause 3: revision of the terms and definitions;
c) Clause 4: revision of the composition of the equipment;
d) Subclause 5.1.2: addition of the outside diameters of borehole probes;
e) Subclause 5.2.1: revision of the time constant;

f) Subclauses 6.1, 6.2, 6.3, and 6.6: revision of the mechanical and environmental performance requirements;

g) Subclause 8.2: revision of the operating time requirements;

h) Clause 10: addition of the mechanical and environmental performance test methods;

i) Subclause 11.2: addition of the pre- and post-logging operation checks;

j) Clause 12: revision of the safety requirements;

k) Clause 13: addition of the characteristics to be specified in the operation and maintenance documentation or certificate of the equipment.

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

Draft	Report on voting
45/1004/CDV	45/1014/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 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

– reconfirmed,

– withdrawn, or

– revised.

1 Scope

This document applies to equipment consisting of:

– a borehole logging probe equipped with a collimated radioisotope (gamma) source (during the actual measurements only) and a detector unit to measure scattered gamma radiation;

– a hoisting system and depth measuring system;

– other instruments and devices (power supply, pulse converter/amplifier, ratemeter, recorder, signal processing and readout units).

This document defines the terminology, specifies the types of apparatus, design and general technical requirements, specific radiation performance, electrical, mechanical, safe and environmental performance requirements. It also defines test and calibration procedures and covers electrical safety and radiation protection issues. Further, it gives recommendations about items included in the manufacturer's operation and maintenance documentation (or certificate).

The purpose of this document is to specify design requirements and performance characteristics of nuclear instrumentation used in boreholes to determine bulk rock density *in situ*. With suitable response charts the measurements can be equated to rock lithology and porosity.

2 Normative references

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 60050-395, *International Electrotechnical Vocabulary (IEV) - Part 395: Nuclear instrumentation - Physical phenomena, basic concepts, instruments, systems, equipment and detectors*

IEC 60359, *Electrical and electronic measurement equipment - Expression of performance*

IEC 61010-1, *Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements*

ISO 2919, *Radiological protection - Sealed radioactive sources - General requirements and classification*

IAEA Safety Standards Series No.SSG-57, *Radiation Safety in Well Logging*