SLOVENSKI STANDARD

SIST HD 371 S1:2003

april 2003

Portable bore-hole logging equipment (down to 300 m) - General characteristics

ICS 73.100.30

Referenčna številka
SIST HD 371 S1:2003(en)

C E N E L E C

ISSUE OF THE COVER SHEET : 1979-04-24

EUROPEAN COMMITTEE FOR ELECTROTECHNICAL STANDARDIZATION

CENELEC HARMONIZATION DOCUMENT

HD 371

IEC 576 (1977 - 1st edition)

Portable bore-hole logging equipment (down to 300 m).
General characteristics

This Harmonization Document was adopted by CENELEC on 1978-06-05.

The National Electrotechnical Committees, members of CENELEC, in

A : Austria
B : Belgium
CH : Switzerland
D : Germany
DK : Denmark
E : Spain
F : France
I : Italy
IRL : Ireland
L : Luxemburg
N : Norway
NL : Netherlands
P : Portugal
S : Sweden
SF : Finland
UK : United Kingdom

Reference of the relevant National Harmonized Standards overleaf

are obliged, in accordance with the CENELEC Internal Regulations, to implement this Harmonization Document in their respective country by

- Issuing harmonized national standard(s) and/or
- Withdrawing conflicting national standard(s)

Latest date of implementation 1980-01-01

Clas. No 42

NORME INTERNATIONALE

INTERNATIONAL STANDARD

CEI
IEC
60576

Première édition
First edition
1977-01

Equipement portatif de radiocarottage (jusqu'à 300 m): Caractéristiques générales

Portable bore-hole logging equipment (down to 300 m): General characteristics

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE R

Pour prix, voir catalogue en vigueur
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PORTABLE BORE-HOLE LOGGING EQUIPMENT (DOWN TO 300 m): GENERAL CHARACTERISTICS

FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by IEC Technical Committee No. 45, Nuclear Instrumentation.

The first draft was discussed at the meeting held in London in 1972, and was revised during the following meetings in The Hague in 1973 and in Milan in 1974. As a result of this latter meeting, a draft, Document 45(Central Office)89, was submitted to the National Committees for approval under the Six Months' Rule in March 1975. Amendments, Document 45(Central Office)97, were submitted to the National Committees for approval under the Two Months' Procedure in February 1976.

The following countries voted explicitly in favour of publication:

Australia	Italy	Turkey
Belgium	Japan	Union of Soviet Socialist Republics
Canada	Poland	United Kingdom
Czechoslovakia	Romania	United States of America
Finland	South Africa (Republic of)	Yugoslavia
France	Sweden	
Israel	Switzerland	

Other IEC publications quoted in this standard:

Publications Nos. 50(391): International Electrotechnical Vocabulary (I.E.V.); Chapter 391, Detection and Measurement of Ionizing Radiation by Electric Means.

68-2-30: Basic Environmental Testing Procedures, Part 2: Tests — Test Db: Damp Heat, Cyclic (12 + 12-hour Cycle).

86: Primary Cells and Batteries.

201: Power Sources for Portable Prospecting Equipment for Radioactive Materials.

253: Power Supply for Air and Land Vehicle-mounted Prospection Equipment for Radioactive Materials.

258: Direct Acting Recording Electrical Measuring Instruments and their Accessories.

348: Safety Requirements for Electronic Measuring Apparatus.

359: Expression of the Functional Performance of Electronic Measuring Equipment.

412: Standard Dimensions of Scintillators.

421: Portable Prospecting Radiation Meters with Geiger-Müller Counter Tube (Linear Scale Instruments).

PORTABLE BORE-HOLE LOGGING EQUIPMENT (DOWN TO 300 m): GENERAL CHARACTERISTICS

CHAPTER I: GENERAL

1. Scope

This standard applies to equipment consisting of easily transportable autonomous components, and is intended for measurements of rock radioactivity or for measurements concerned with the evaluation and working of deposits. It does not apply to simple instruments for exploration at less than 20 m in depth, nor to vehicle-mounted equipment.

The equipment includes:

1.1 One or several measuring probes (natural background gamma logging).

1.2 A device for the mechanical and electrical connection of the probe with the measuring equipment which may include:

— a supporting cable with a winder and pulley measuring the length of cable released (bathymeter) for logging where the probe descends by gravity (vertical or subvertical dips of more than 55 grades [50°] with respect to the horizontal),

— a rigid or semi-rigid device to move the probe forward in holes having dips of less than 55 grades (50°) with respect to the horizontal.

1.3 A radiometric indicator, usually a counting ratemeter.

1.4 Possibly a recording device, usually of analogue type, the operation of which is proportional to the movement of the probe. Use could also be made of a digital recording device or of a data acquisition system which records probe position in the hole.

2. Object

To establish uniform requirements for the characteristics of each component and for each corresponding test method.

3. Terminology

The general terminology is in agreement with the definitions of IEC Publication 421. Portable Prospecting Radiation Meters with Geiger-Müller Counter Tube (Linear Scale Instruments).

For evaluation of functional performances, the terminology fixed by IEC Publication 359, Expression of the Functional Performance of Electronic Measuring Equipment, has been applied.

The term "probe" is used within the meaning of Chapter 391 of the International Electrotechnical Vocabulary (I.E.V.), Detection and Measurement of Ionizing Radiation by Electric Means:

"That part of a radiation measuring assembly consisting of an envelope of convenient geometrical form containing a radiation detector and possibly a preamplifier and certain functional units. Its form and construction are usually such as to permit its operation in places of difficult access, or remote from the associated apparatus, or for scanning of a surface or volume." (I.E.V. 391-13-05)

4. Test conditions

Unless otherwise mentioned in this standard for certain types of instruments, the reference conditions, the standard test conditions, the rated and the limit operating conditions, the storage and transport conditions are the same as for the Geiger-Müller counter tube prospecting portable radiation meters and are described in IEC Publication 421.

5. Categories of instruments

Two categories of instruments are defined, differing by the environmental conditions that they shall withstand.

Category A: Instruments intended for use in temperate or tropical regions.

Category B: Instruments intended for use in cold regions.

These categories are divided into accuracy classes, as in Sub-clause 14.2.

CHAPTER II: REQUIREMENTS

SECTION ONE — PROBE

The probe consists of a casing containing the detector and the electronic circuits necessary for shaping the signals and supplying power.

As uranium content ranges from a few millionths to several tenths, the flux densities intercepted vary in a ratio of more than 10^4. In view of the random character of the phenomenon measured, it may be desirable to provide several types of probe to cover this range.

6. Shell

6.1 The shell of the probe shall be of non-corrosive material resistant to abrasion and mechanical forces and not having any magnetic effect on the components inside it; the recommended materials are stainless steel, brass or bronze. Special care should be taken in using stainless steel/stainless steel threaded joints, because of possible problems in dismantling.

6.2 The probe diameter shall be compatible with that of the holes being explored. Diameters of uranium prospecting holes ranging approximatively from 27 mm to 152 mm, the recommended probe diameters are:

22 ± 1 mm $^7/_8$ in	25 ± 1 mm 1 in	32 ± 1 mm $1^3/_8$ in	43 ± 1 mm $1^{11}/_{16}$ in	52 ± 2 mm $2^1/_{16}$ in

6.3 The length of the probe shall not exceed 1.5 m.

6.4 The probe shall be waterproof and able to withstand the pressures of water or dirt encountered in the bore-holes; the thickness of the body of the probe should be not less than 1 mm; each probe should be checked under a water pressure of $8 \cdot 10^6$ Pa maintained for 1 h. On completion of this test, the device should be checked for proper functioning.

6.5 The connecting of the probe to the end of the cable shall not require any special tools and it shall be possible to perform the operation rapidly.

7. Detector and associated electronic circuits

The detection device is usually a Geiger-Müller counter tube or a scintillator. When selecting the dimensions of the detector, in particular the length, account should be taken of the type of working conditions envisaged: the thickness of the anomalies to be detected, the rate of exploration, the response time of the measuring circuit, the mode of measurement (at a single point, at a number of discrete points or continuously).

The reason for this is that, in order to record the maximum value of an anomaly of slight thickness, it is necessary for the detector to "dwell" opposite that anomaly for two circuit time constants (2 RC) for a 13% approximation and 4 RC for a 2% approximation.

With continuous advancement of the detector, the detector length must be sufficient for this. Furthermore, it must be considered in this case that the rise and fall "fronts" seem lengthened on the analogue record by a value corresponding to 4 RC and that the apparent length of the anomaly is increased by the detector and fall front lengths.

For example, at a rate of 0.6 m/min and with 2 RC = 2 s, 2 cm of detector length are necessary to determine the amplitude of a "fine and collimated" anomaly within 13% (4 cm for 2%). The rise front is 4 cm longer and the apparent length of the anomaly is increased by the detector length plus 4 cm.

With a 10-cm detector and 2 RC = 4 s, the maximum speed to define such an anomaly within 13% shall be 1.5 m/min (0.75 m/min within 2%).

7.1 *Geiger-Müller counter tube probes*

The Geiger-Müller counter tube probes are often used for localization, evaluation and working of radioactive ore deposits.

The probe can comprise one or several Geiger-Müller counter tubes.

7.1.1 *Dimensions*

The effective length shall be not greater than 10 cm, to permit precise localization.

7.1.2 *Associated electronic circuits*

The associated electronic circuits shall be such that after passing through 300 m of logging cable connected to the recommended measuring equipment, and depending on the use of the probe, the following characteristics are obtained:

a) in an infinite homogeneous medium, containing 0.1% uranium in equilibrium, 14 < Zeq.* < 18, or equivalent model (under consideration):
- the counting rate shall be greater than 40 $c.s^{-1}$;
- the difference of the detection efficiencies between two probes of the same type shall be not greater than ±7% under normal test conditions, ±10%, ±15% respectively under rated and limit operating conditions;
- the resolution time shall be not greater than 120 µs;

b) in an ore containing 1% uranium, in equilibrium, infinite and homogeneous, 14 < Zeq.* < 18, or equivalent model (under consideration):
- the fractional counting loss shall be not greater than 6%;

c) the output impedance shall be as low as possible, preferably less than 50 Ω. The amplitude of the signals transmitted should be not less than 250 mV for a counting rate of 500 $c.s^{-1}$. The pulse rise time should be between 0.1 µs and 2 µs. The output shall be capable of sustaining a short circuit without damage.

7.1.3 *Power supply*

The power supply can either be built into the probe or be delivered through the cable.

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* Zeq.: Matrix equivalent atomic number.